Project design document form for CDM project activities

(Version 06.0)

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	CECIC Zhangbei Dayangzhuang Wind Farm Project
Version number of the PDD	04 (update due to renewal of crediting period)
Completion date of the PDD	29/05/2015
Project participant(s)	CECIC Wind Power (Zhangbei) Yunwei Co. Ltd. (The developer) Vitol SA- Switzerland (The buyer)
Host Party	People's Republic of China
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral Scope 1: Energy Industries (renewable/non-renewable); ACM0002: “Grid-connected electricity generation from renewable sources”, Version 16.0.0 For standardized baseline, it’s not applicable
Estimated amount of annual average GHG emission reductions	89,652 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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"CECIC Zhangbei Dayangzhuang Wind Farm Project (UNFCCC Reference Number: 1855)" was registered as a CDM project on 27/10/2008. The first 7 year renewable crediting period started on 27/10/2008 and expired on 26/10/2015. The project participant, CECIC Wind Power (Zhangbei) Yunwei Co., Ltd., is applying for the second crediting period from 27/10/2015 to 26/10/2022.

CECIC Zhangbei Dayangzhuang Wind Farm Project (hereafter referred to as the project activity) is located in Zhangbei county, Hebei province, P.R. China. The project activity is the generation of electricity from wind and the supply of this electricity to the North China Power Grid (NCPG), and the project activity has installed and operates 66 wind turbines with a capacity of 750 kW each. According to the description of FSR, the available generation hour of the project is 1950 hours with a load factor of 0.2226 which considered the wind resource analysis data from 1971 to 2006. Therefore, the project scenario is the installation of 49.5 MW of renewable energy power generation capacity. The project Activity is expected to supply about 96,530MWh electricity to the power grid per year.

As the NCPG is dominated by fossil fuel-fired power generation, the establishment of the project activity will lead to greenhouse gas (GHG) emission reductions. Following the methodology, the emission reductions are estimated to be on average 89,652 tonnes of CO_2 equivalent (tCO_2e) per year, and 627,564 tCO_2e over the second renewable crediting period. The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity: electricity delivered to the NCPG by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

The project activity will therefore helps reduce GHG emissions versus the high-growth, coal-dominated business-as-usual scenario. Furthermore, the project will promote local sustainable development through the following aspects:

- reducing CO_2, SO_2 and NOx emissions;
- creating local employment opportunity during the assembly and installation of wind turbines, and for operation of the proposed project; and
- reducing other particulate pollutants resulting from the fossil fuel power plants compared with a business-as-usual scenario.

A.2. Location of project activity

A.2.1. Host Party

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People's Republic of China (P. R. China)

A.2.2. Region/State/Province etc.

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Hebei Province

A.2.3. City/Town/Community etc.

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Zhangbei County, Zhangjiakou City

A.2.4. Physical/Geographical location

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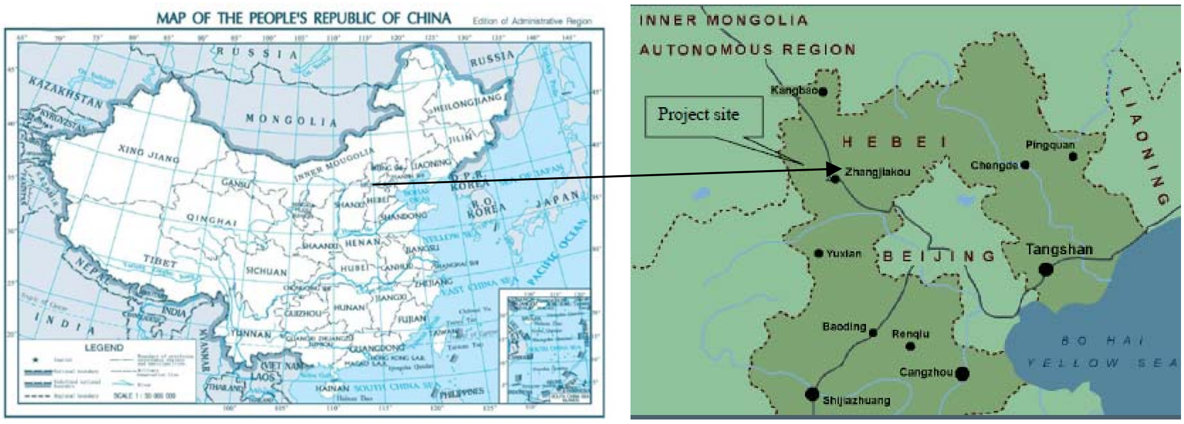
The project activity is located in the southwest of Zhangbei county, Hebei province, P.R. China. The geographic coordinate of the project site is longitude 114°33'4'' East to 114°37'23'' East and latitude 41°07'22'' North to 41°10'36'' North. The altitude of the site ranges from 1422m to 1562m above mean sea level. Figure 1 shows the location of the project activity.



A.3. Technologies and/or measures

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According to the analysis in the FSR approved by local government, the net average operation hours of the project activity is 1950h, and the project activity provides total installed capacity of 49.5MW so the net electricity supplied to the grid is expected to be 96,530MWh annually. The electricity generated from the project is transmitted to Zhangbei 220kV substation of NCPG.

Based on the condition of the project site, the project installed and operated 66 wind turbines of 750kW. The selected turbines are manufactured by Zhejiang Windey Wind Generating Engineering Co., Ltd. It is planned that the Project will be operational for a minimum of 21 years. The detailed parameters of selected turbines are provided in table 1.

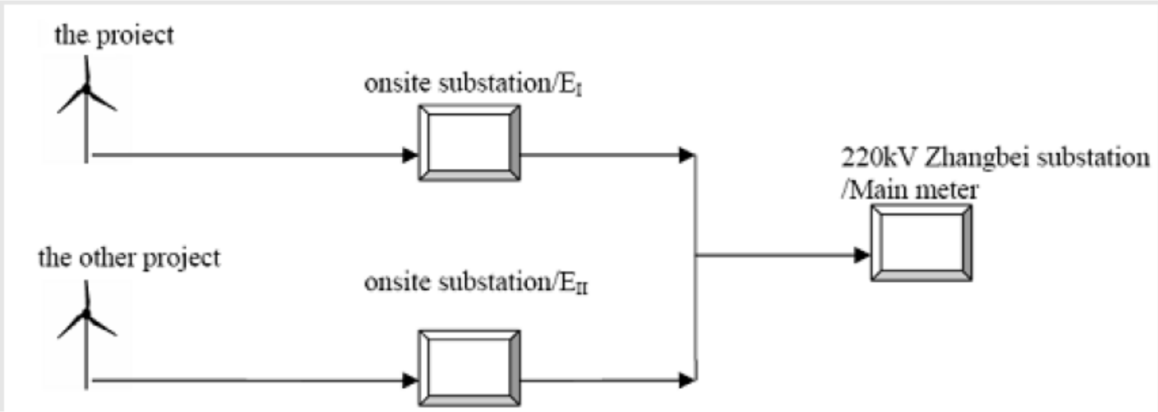
Table 1 Key technology to be employed at the project wind farm

Parameter	Value
Manufacture	Zhejiang Windey Wind Generating Engineering Co., Ltd.
Model	WD49/750kW
Rated power (kW)	750
Number of rotors	3
Rotor diameter (m)	49
Swept area (m^2)	1886
Rated rotor speed (rpm)	15
Cut-in wind speed (m/s)	3.5
Rated wind speed (m/s)	15
Cut-out wind speed (m/s)	23
Hub height of the wind turbines (m)	50 to 65
Rated Voltage	690

Each wind turbine has a transformer from 690V to 35KV. The project activity installed one 110kV/35kV transformer with the capacity of 50MVA. The wind farm is connected with the expanded 110kV substation, and then connected with 220kV Zhangbei substation via 110kV trandmission line.

The electricity supplied to NCPG by CECIC Zhangbei Dayangzhuang Wind Farm Project shared one electric flow meter (the main meter) at 220kV level with another wind farm (UNFCCC ref:4095,

CECIC Zhangbei Gaojialiang Wind farm Project), so the meter at 220kV level measures the total electricity exchanged between NCPG and the two wind farms.



A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	CECIC Wind Power (Zhangbei) Yunwei Co. Ltd.	No
Switzerland	Vitol SA	No

A.5. Public funding of project activity

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No public funding has been secured for this project activity.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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1. The approved large-scale consolidated methodology ACM0002: “Grid-connected electricity generation from renewable sources”(Version 16.0.0), in effect as of EB 81;
2. The approved “Tool for demonstration and assessment of additionality”(Version 02), in effect as of EB 16 and revised by EB 22[1];

3. The project includes a newly built wind power plant, the baseline scenario was prescribed in the ACM0002 (Version 16.0.0) and the “Combined tool to identify the baseline and demonstrate additionality” (Version 05.0.0) does not need to be applied in the case of Greenfield projects as per ACM0002.

4. The approved “Tool to calculate the emission factor for an electricity system”(Version 04.0), in effect as of EB 75, and

5. The approved Methodological Tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”(Version 03.0.1), in effect as of EB 66.

No fossil fuel will be consumed by the project, so, the “*Tool to calculate project or leakage* CO_2 *emissions from fossil fuel combustion”* was not applied.

Further information pertaining to the methodology can be obtained at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

B.2. Applicability of methodology and standardized baseline

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The Methodology ACM0002 (Version 16.0.0) is chosen and applicable to the project activity due to the following reasons:

No.	Applicability	Explain
1	This methodology is applicable to grid-connected renewable energy power generation project activities that (a) install a Greenfield power plant; (b) involve a capacity addition to (an) existing plant(s); (c) involve a retrofit of (an) existing operating plants/units; (d) involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) involve a replacement of (an) existing plant(s) /unit(s).	The Project belongs to grid-connected renewable energy power generation project activities that (a) install a Greenfield power plant.
2	The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The Project is the installation of a new grid connected wind power plant.
3	In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a	The Project is the installation of a new grid connected wind power plant. So this applicability condition does not need to be

[1] According to the “CDM project standard”, version 09.0, the additionality is not required to reassess and update for renewal of crediting period. Therefore, the assessment and demonstration of additionality in the registered CDM-PDD is not updated in the revised CDM-PDD.

	minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	considered.
4	In case of hydro power plants, one of the following conditions must apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m^2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m^2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m^2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m^2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	The Project is not a hydro power plant, so this applicability condition does not need to be considered.
5	In the case of integrated hydro power projects, project proponent shall: Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	The Project is not a hydro power project, so this applicability condition does not need to be considered.
6	The methodology is not applicable to the following: (1) Project activities that involve switching from fossil	(1)The Project does not involve switching from fossil fuels to

	fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (2) Biomass fired power plants/units.	renewable energy sources at the site of the project activity; (2) The Project is not a biomass fired power plant.
7	In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance.	The Project is the installation of a new grid connected wind power plant. So this applicability condition does not need to be considered.

The applicability criteria stated in methodology ACM0002 (Version 16.0.0) are met on the basis of the reasons above.

For standardized baseline, it's not applicable.

B.3. Project boundary

According to the methodology ACM0002 version 16.0.0, the spatial extent of the project activity boundary includes the wind power plant and the Substation of the project activity. Electricity generated by the project will be delivered to the NCPG. According to the latest guideline[2] issued by the China DNA on 11/05/2015, the boundary of the North China Power Grid is composed of the Beijing Power Grid, the Tianjin Power Grid, the Hebei Power Grid, the Shanxi Power Grid, the Shandong Power Grid, and the Inner Mongolia Power Grid. Therefore, the spatial extent of the project boundary also includes all the power plants physically connected into the NCPG.

The greenhouse gases and emission sources included in or excluded from the project activity boundary are shown in Table 2.

Table 2: Emissions sources included in or excluded from the project activity boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants connected into the NCPG that are displaced due to the project activity	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project scenario	Project emission	CO_2	No	The project is a wind power project. Project emissions should not be considered according to ACM0002.
		CH_4	No	
		N_2O	No	

In addition to the table, a flow diagram of the project boundary is presented below, physically delineating the Project activity, based on the description provided in section A.3 above. The flow diagram includes the equipment, systems and flows of mass and energy.

2 *2014 baseline emission factors for regional power grids in China,* issued by China DNA (http://cdm.ccchina.gov.cn/Detail.aspx?newsId=51651&TId=3)

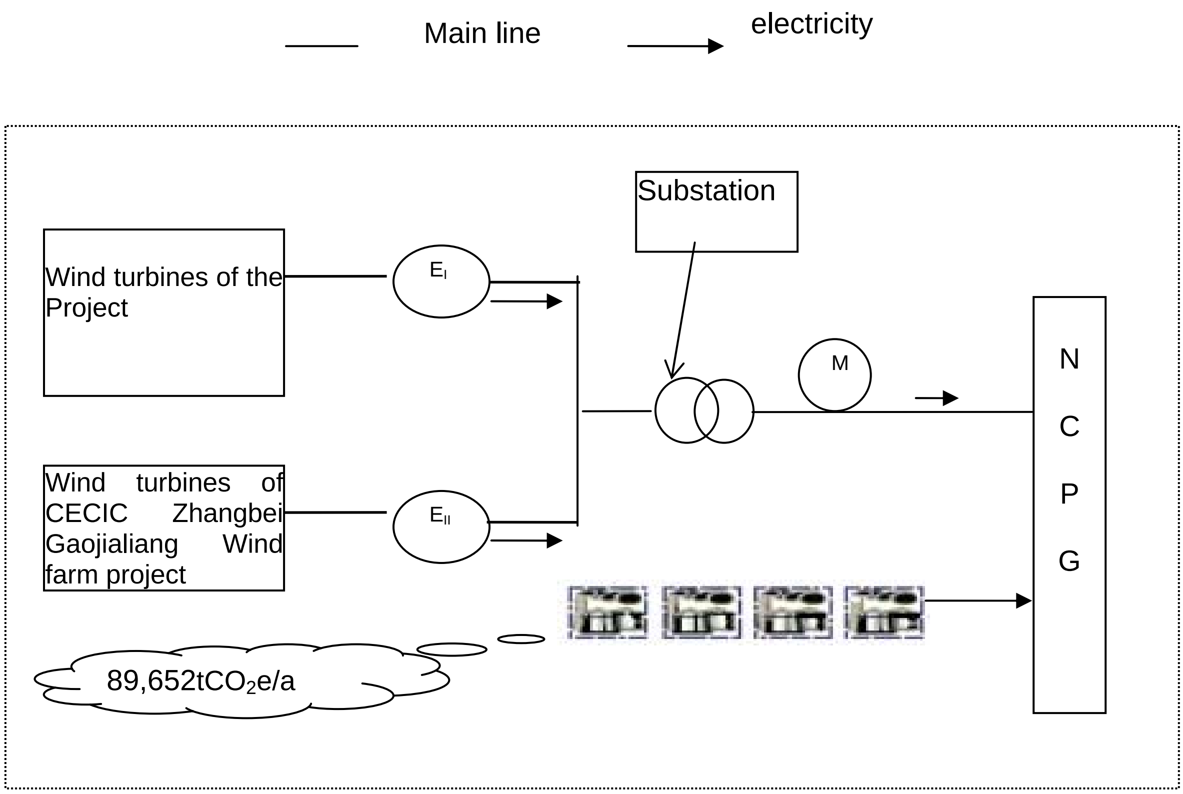

Figure 2. The flow diagram of the project activity boundary

B.4. Establishment and description of baseline scenario

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As the project activity is the installation of a Greenfield power plant, according to the methodology ACM0002 (Version 16.0.0), the baseline scenario is the following:

> *Electricity delivered to the grid by the Project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the Combined Margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".*

The project displaces electricity generated in NCPG and therefore NCPG is chosen as the baseline scenario boundary. As the project is applying for renewal of crediting period, the continued validity of the baseline is to be demonstrated in accordance with "*Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period*" (EB66, version 03.0.1) as follows:

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

The project activity is a renewable wind power project that supplies electricity to displace electricity from NCPG. The project activity is claiming the emission reductions from the net exported quantity of electricity only. As the project displaces electricity generated in NCPG, combined margin (CM) is used to determine baseline emission factor.

As per "China Electric Power Yearbook 2013", the installed capacity in NCPG is as follows:

	Hydropower	Thermal	Nuclear	Wind power and Other sources	Total
Installed capacity*	7,402	235,710	0	30,315	273,427

(MW)					
Percentage (%)	2.71	86.21	0	11.09	100

* The data is calculated based on data from “China Electric Power Yearbook 2013”.

The data in above table illustrates that NCPG is still dominated by the thermal power plants. Hence, the baseline remains unchanged and is in compliance with all the relevant mandatory national and/or sectoral policies.

Step 1.2: Assess the impact of circumstances

The plant still has the same technical characteristics and energy sources and its energy production has been sold to NCPG. These circumstances continue during the second crediting period and therefore, do not have an impact on the current baseline emissions.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity: electricity delivered to the NCPG by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, and it will not request an investment by the project proponent or third party. Therefore this condition is not applicable to the project activity.

Step 1.4: Assessment of the validity of the data and parameters

Since there are some parameters, which were determined at the start of the first crediting period and not monitored during the first crediting period, are not valid anymore. Application of Steps 1.1, 1.2 and 1.3 confirmed that the current baseline is still valid for the second crediting period but the data and parameters need to be updated. Therefore, step 2 is used.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

In accordance with above assessment in step 1.1, 1.2 ,1.3,and 1.4, the current baseline is still valid for the second crediting period, data and parameters of baseline emissions were updated for the renewal of crediting period.

Step 2.2 Update the data and parameters

In context with step 1.4, the emission factor has been updated as per the latest available data. Details are given in section B.6.

B.5. Demonstration of additionality

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Not applicable.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Emission reduction for the Project activity is calculated based on ACM0002 (Version 16.0.0), and the Tool to calculate the emission factor for electricity system (Version 04.0).

This section includes the following parts:
·Calculate the project GHG emissions;
·Calculate the baseline GHG emissions;
·Calculate the project leakage;
·Calculate the emission reductions.

I. Calculate the project GHG emissions

The project activity is a windpower project, no fossil fuel will be consumed according to the methodology ACM0002. The project emission should not be considered, that is $PE_y = 0$ tCO_2e.

II. Calculate baseline GHG emissions

1. Calculate the baseline emission factor

As per the methodology ACM0002 version 16.0.0, *Tool to calculate the emission factor for an electricity system* version 04.0.0 is applied to calculate the baseline emission factor.

According to the methodological tool, the baseline emission factor is calculated in the following six steps:

STEP 1. Identify the relevant electricity systems

The electricity generated by the project will be supplied to the NCPG. In the absence of the project activity, both the existing power plants and the power plants to be built in the foreseeable future within the NCPG would supply electricity comparable to that supplied by the project. As per *2014 baseline emission factors for regional power grids in China* published by China DNA, the NCPG includes the provincial grid spatial extent of the Beijing Power Grid, the Tianjin Power Grid, the Hebei Power Grid, the Shanxi Power Grid, the Shandong Power Grid, and the Inner Mongolia Power Grid..

The NCPG has imported electricity from the Northeast Power Grid (NEPG) and Northwest Power Grid (NWPG). As per the methodological tool, referred to *2014 baseline emission factors for regional power grids in China,* option (b), the simple Operating Margin emission factor of the electricity exporting grid, determined as described in Step 4 (a) was selected to calculate the CO_2 emission factor for net electricity imports from the NEPG and the NWPG by the NCPG.

STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the Operating Margin and Build Margin emission factor:
Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.
The Option I was selected for the project.

STEP 3. Select a method to determine the Operating Margin (OM)

The *Tool to calculate the emission factor for an electricity system* Version 04.0.0 offers four options for the calculation of the Operating Margin emission factor(s) ($EF_{grid,OM,y}$):

(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.
The simple OM method (Option a) can only be used if low-cost/must-run resources constitute less than 50 per cent of total grid generation (excluding electricity generated by off-grid power plants) in:

1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

Because low-cost/must run resources[3] constitute less than 50% of total amount of grid generating output from 2008 to 2012 in the NCPG[4], option (a) Simple OM was thus selected.

According to the methodological tool, the following options were selected:

Ex-ante option: If the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

STEP 4. Calculate the Operating Margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the North China Power Grid, not including low-cost/must-run power/units. The *Tool to calculate the emission factor for an electricity system* version 04.0.0 offers two options for the calculating of the Simple OM.

- Based on data of net electricity generation and CO_2 emission factor of each power plant/unit (Option A), or
- Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (Option B).

Option B can only be used if:
(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

Option A should be preferred and must be used if fuel consumption data is available for each power plant/unit. As the fuel consumption data for each power plant/unit is not available in China, Option A is not applicable. Total net electricity generation of all power plants serving the North China Power Grid and the fuel types and total fuel consumption of the North China Power Grid are available from *China electric power yearbook* and *China energy statistical yearbook*, and the following conditions can be satisfied:
(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation.
So, the Project uses Option B for calculating the simple OM emission factor as follows:

[3] Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

[4] 1.19%, 2.00%, 3.13%, 3.76% and 4.93% from 2008 to 2012 respectively. Data are calculated according to the information that come from the China Electric Power Yearbooks 2009- 2013.

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y})}{EG_y} \quad (1)$$

Where

$EF_{grid,OMsimple,y}$ Simple Operating Margin CO_2 emission factor in year *y* (tCO_2/MWh);

$FC_{i,y}$ Amount of fossil fuel type *i* consumed in the NCPG in year y (mass or volume unit);

$NCV_{i,y}$ Net calorific value (energy content) of fossil fuel type *i* in year y (GJ/mass or volume unit);

$EF_{CO2,i,y}$ CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ);

EG_y Net electricity generated and delivered to the grid by all power sources serving the North China Power Grid, not including low-cost/must-run power plants/units, in year *y* (MWh);

i All fossil fuel types combusted in power sources in the North China Power Grid in year y;

y Because the project activity is a new built wind power project, the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option).

$$EG_y = GEN_y \times (1 - AER_y) \quad (2)$$

Where:

GEN_y electricity generated by all power sources serving the North China Power Grid, not including low-cost/must-run power plants/units, in year *y* (MWh);

AER_y the average auxiliary electricity consumption rate(%) of all power sources serving the North China Power Grid, not including low-cost/must-run power plants/units, in year y.

The data on electricity generation and auxiliary electricity consumption rate for calculating the operating margin emission factor ($EF_{grid,OM,y}$) are obtained from *China Electric Power Yearbook 2011/2012/2013*. The data on different fuel consumptions for power generation and the net calorific values of the fuels are obtained from *China Energy Statistical Yearbook 2011/2012/2013*. The emission factors of the fuels employed are obtained from Table 1.3 and Table 1.4 on page 1.21-1.24 of Volume 2 of *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. The lower values of the 95% confidence intervals in Table 1.4 are used for the emission factors of the fuels employed.

According to *2014 baseline emission factors for regional power grids in China*, the Simple Operating Margin CO_2 emission factor ($EF_{grid,OMsimple,y}$) of the NCPG is 1.0580 tCO_2/MWh (see Appendix 4 for details).

STEP 5. Identify the Build Margin Emission Factor

In terms of vintage of data, project participants chose Option 1:

Option 1: For the first crediting period, calculate the Build Margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the Build Margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the Build Margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

The sample group of power units *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5-units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\geq 20\%}$, in MWh);

(c) From $SET_{5-units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. Ignore steps (d), (e) and (f).

However, under the current circumstances in China, the power plants consider the Build Margin data as important business data and will not have them published. Therefore, it is difficult to obtain the data of five power plants that have been put into operation most recently or the newly built power plant capacity additions in the electricity system that comprise 20% of the system generation. In allusion to the situation, the CDM EB accepts the following deviation in the application of the methodology[5].

1) Use of capacity additions during the last 1~3 years for estimating the Build Margin emission factor for grid electricity.
2) Use of weights estimated using installed capacity in place of annual electricity generation, being approximately conservative.

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

The Build Margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (3)$$

Where

$EF_{grid,BM,y}$ Build Margin CO_2 emission factor in year y (tCO_2/MWh);

$EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh);

$EF_{EL,m,y}$ CO_2 emission factor of power unit *m* in year y (tCO_2/MWh);

m Power units included in the Build Margin;

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[5] EB guidance for “Request for guidance: Application of AM0005 and AMS-ID in China, 07/10/2005”: Request for clarification on use of approved methodology AM0005 for several projects in China. http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM

y Most recent historical year for which power generation data is available.

As per the methodology deviation, China DNA published the BM calculation method as follow:

Because current statistics data can not separate the installed capacity of coal, oil and gas fueled power generation, the method adopted for BM calculation is as follow:

Firstly make use of the latest energy balance data to calculate all sorts of emission scale in total emission from coal, oil and gas fueled power generation; then based on the emission factor under the business best technology, calculated the fueled power emission factor of the grid; last multiply the fuelled power emission factor and fuelled power proportion of the total power, it's the BM of the grid.

Detailed step and formula as follow:

Sub-step 1. Calculation of the share of CO_2 emissions from solid, liquid and gaseous fuels

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \tag{4}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \tag{5}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \tag{6}$$

Where

$F_{i,j,y}$ The consumption of fuel i in province j in year y (unit of mass or volume);

$NCV_{i,y}$ Net calorific value (energy content) of fuel *i* in year *y* (GJ/mass or volume unit, gas fuel/ GJ/m^3);
$EF_{CO_2,i,j,y}$ CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ).

Coal, Oil and Gas is the foot-index for solid fuels, liquid fuels and gas fuels.

Sub-step 2. Calculation of the emission factor of thermal power

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \tag{7}$$

$EF_{Coal,Adv,y}$, $EF_{Oil,Adv,y}$ and $EF_{Gas,Adv,y}$ are emission factors of the best efficiency commercial available coal-fired, oil-fired and gas-fired generation technologies.

Sub-step 3. Calculation of the BM in the Grid

$$EF_{grid,BM,y} = \frac{\Delta CAP_{Thermal}}{\Delta CAP_{Total}} \times EF_{Thermal,y} = \frac{CAP_{Thermal,y} - CAP_{Thermal,y-N}}{CAP_{Total,y} - CAP_{Total,y-N}} \times EF_{Thermal,y} \quad (8)$$

$CAP_{Total,y}$ Is the total installed capacity in the North China Power Grid in year y, $CAP_{Thermal,y}$ is the total installed capacity of thermal power in the North China Power Grid in year y. N is the shortest vintage that the added installed capacity nearest to 20% of total installed capacity in the North China Power Grid.

The data on installed capacity for calculating the build margin emission factor ($EF_{grid,BM,y}$) are obtained from *China Electric Power Yearbook 2011-2013*. The data on different fuel consumptions for power generation and the net calorific values of the fuels are obtained from *China Energy Statistical Yearbook 2013*. The emission factors of the fuels employed are obtained from Table 1.3 and Table 1.4 on page 1.21-1.24 of Chapter 1, Volume 2 of *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. The lower values of the 95% confidence intervals in Table 1.4 are used for the emission factors of the fuels employed.

Based on *2014 baseline emission factors for regional power grids in China* published by China DNA, the Build Margin Emission Factor ($EF_{grid,BM,y}$) of the North China Power Grid could be obtained to be 0.5410 tCO_2/MWh.

STEP 6. Calculate the Combined Margin emissions factor

The Combined Margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM} \quad (9)$$

Where

$EF_{grid,CM,y}$ Combined Margin CO_2 emission factor in year y (tCO_2/MWh);

W_{OM} Weighting of Operating Margin emissions factor (%);

W_{BM} Weighting of Build Margin emissions factor (%).

2. Calculate baseline GHG emissions

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. ACM0002 assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants.

The baseline emissions are to be calculated as follows:

$$BEy = EGy \times EF_{grid,CM,y} \quad (10)$$

Where

BE_y Baseline emission in year y (tCO_2);

EGy The net electricity supplied to the grid by the Project in year y (MWh); the net generation is calculated as exports(EG_{export}) minus imports(EG_{import}).

III. Calculate Leakage GHG emissions

As per the methodology ACM0002 (version 16.0.0), no leakage needs to be considered in the Project, $LE_y = 0$ tCO_2e.

IV. Calculate the emission reductions

The emission reduction (ER_y) during a given year y is calculated as follows:

$$ERy=BEy-PEy-LEy \quad (11)$$

ERy=BEy= $EG_y \times EF_{grid,CM,y}$ =(EG_{export} - EG_{import}) $\times EF_{grid,CM,y}$

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$FC_{i,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed in the NCPG in year y.
Source of data	*China energy statistical yearbooks, 2011-2013*
Value(s) applied	See Appendix 4
Choice of dataorMeasurement methods and procedures	The data obtained from the official publication *China energy statistical yearbook*, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system* version 04.0.0.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$NCV_{i,y}$
Unit	GJ/mass or volume unit
Description	Net calorific value (energy content) of fuel type *i* in year y.
Source of data	*China energy statistical yearbooks*, *2011-2013*
Value(s) applied	See Appendix 4
Choice of dataorMeasurement methods and procedures	The data obtained from the official publication *China energy statistical yearbook*, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system* version 04.0.0.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data/Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fuel type *i* in year y.
Source of data	*2006 IPCC guidelines on national GHG inventories, Volume 2 Energy, Chapter 1, table1.3-table 1.4*
Value(s) applied	See Appendix 4
Choice of dataorMeasurement methods and procedures	Regional or national average default values are unavailable, so IPCC default values at the lower limit of the uncertainty at a 95% confidence interval are used, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system* version 04.0.0.
Purpose of data	Calculation of baseline emissions

Additional comment	-

Data/Parameter	GEN_y
Unit	MWh
Description	Electricity generated by all power sources serving North China Power Grid in year *y*.
Source of data	*China electric power yearbooks*, *2011-2013*
Value(s) applied	See Appendix 4
Choice of dataorMeasurement methods and procedures	Regional or national average default values are unavailable, so IPCC default values at the lower limit of the uncertainty at a 95% confidence interval are used, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system* version 04.0.0.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	AER_y
Unit	%
Description	Auxiliary electricity consumption rate of all power sources serving North China Power Grid.
Source of data	*China electric power yearbooks*, *2011-2013*
Value(s) applied	See Appendix 4
Choice of dataorMeasurement methods and procedures	Regional or national average default values are unavailable, so IPCC default values at the lower limit of the uncertainty at a 95% confidence interval are used, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system* version 04.0.0.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$F_{i,j,y}$
Unit	mass or volume unit
Description	Consumption of fuel i in province j in year y.
Source of data	*China electric power yearbooks*, *2011-2013*
Value(s) applied	See Appendix 4
Choice of dataorMeasurement methods and procedures	The data obtained from the official publication *China energy statistical yearbook*, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system* version 04.0.0.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{Coal,Adv,y}$
Unit	tCO_2/MWh
Description	Emission factor of the best efficiency, commercially available coal-fired generation technology.

Source of data	*2014 baseline emission factors for regional power grids in China* published by China DNA
Value(s) applied	0.7851
Choice of dataorMeasurement methods and procedures	The data obtained from the China DNA, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system version 04.0.0*.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{Oil,Adv,y}$
Unit	tCO_2/MWh
Description	Emission factor of the best efficiency, commercially available oil-fired generation technology.
Source of data	*2014 baseline emission factors for regional power grids in China* published by China DNA
Value(s) applied	0.5138
Choice of dataorMeasurement methods and procedures	The data obtained from the China DNA, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system version 04.0.0*.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{Gas,Adv,y}$
Unit	tCO_2/MWh
Description	Emission factor of the best efficiency, commercially available gas-fired generation technology.
Source of data	*2014 baseline emission factors for regional power grids in China* published by China DNA
Value(s) applied	0.3695
Choice of dataorMeasurement methods and procedures	The data obtained from the China DNA, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system version 04.0.0*.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$CAP_{Total,y}$
Unit	MW
Description	Total installed capacity in North China Power Grid in year y
Source of data	*China electric power yearbooks*, *2011-2013*
Value(s) applied	See Appendix 4

Choice of dataorMeasurement methods and procedures	The data obtained from the China DNA, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system version 04.0.0*.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$CAP_{Thermal,y}$
Unit	MW
Description	Total installed capacity of thermal power in North China Power Grid in year y
Source of data	*China electric power yearbooks*, *2011-2013*
Value(s) applied	See Appendix 4
Choice of dataorMeasurement methods and procedures	The data obtained from the China DNA, satisfying the requirement of latest version of *Tool to calculate the emission factor for an electricity system version 04.0.0*.
Purpose of data	Calculation of baseline emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

>>

I. Calculate the project GHG emissions

The project is a wind power project, and the project emissions should not be considered as per the methodology ACM0002, $PE_y = 0$ tCO_2e.

II. Calculate the baseline GHG emissions

1. Calculate the baseline emission factor

According to the methodological tool, W_{OM} and W_{BM} are by default 0.75 and 0.25 respectively in the second crediting period. Therefore the combined baseline emission factor:

$$EF_{grid,CM,y} = 1.0580 \times 0.75 + 0.5410 \times 0.25 = 0.92875 \text{ tCO}_2\text{/MWh}$$

2. Calculate baseline GHG emissions

According to the FSR of the project, the annual net feed-in electricity is estimated to be 96,530MWh, so the annual baseline emission of the project is

$$BE_y = 96{,}530\text{MWh} \times 0.92875 \text{ tCO}_2\text{/MWh} = 89{,}652\text{tCO}_2$$

III. Estimate project leakage emissions:

As per the methodology ACM0002 (version 16.0.0), no leakage needs to be considered in the Project, $LE_y = 0$ tCO_2e.

IV. Estimate emission reductions

As per formula in section B.6.1, *ERy*=89,652-0-0=89,652tCO_2, and the annual emission reductions of the project are 89,652tCO_2e.

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
27/10/2015-26/10/2016	89,652	0	-	89,652
27/10/2015-26/10/2017	89,652	0	-	89,652
27/10/2017-26/10/2018	89,652	0	-	89,652
27/10/2018-26/10/2019	89,652	0	-	89,652
27/10/2019-26/10/2020	89,652	0	-	89,652
27/10/2020-26/10/2021	89,652	0	-	89,652
27/10/2021-26/10/2022	89,652	0	-	89,652
Total	627,564	0	-	627,564
Total number of crediting years	7			
Annual average over the crediting period	89,652	0	-	89,652

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

The main monitored data of the project is the electricity delivered to the grid by the project (EG_{export}) and the power imported from the grid (EG_{import}). The net generation is calculated as exports minus imports.

Data/Parameter	E_I
Unit	MWh
Description	Electricity exported to the grid by the project (CECIC Zhangbei Dayangzhuang Wind Farm Project).
Source of data	Meter reading record of onsite substation E_I meter
Value(s) applied	To be determined
Measurement methods and procedures	Measuring continuously / Recording weekly (each Sunday at 24:00 and last day of the month)
Monitoring frequency	N/A

QA/QC procedures	Electricity was measured continuously by the meter EI. Trained Staff from the Wind Farm recorded the meter readings manually on a weekly/monthly basis (each Sunday at 24:00 and last day of the month). Reading records were saved as both hard and electrical copy. The meter readings were also transferred via a remote transmission line to the grid company. The meter was calibrated according to the Chinese industrial standard. The calibration is carried out annually by a qualified organization with the records being supplied to the grid company and project owner.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data/Parameter	E_{II}
Unit	MWh
Description	Electricity exported to the grid by the other Project (Gaojialiang project)
Source of data	Meter reading record of onsite substation E_{II} meter
Value(s) applied	To be determined
Measurement methods and procedures	Measuring continuously / Recording weekly (each Sunday at 24:00 and last day of the month)
Monitoring frequency	N/A
QA/QC procedures	Electricity was measured continuously by the meter E_{II}. Trained Staff from the Wind Farm recorded the meter readings manually on a weekly/ monthly basis (each Sunday at 24:00 and last day of the month). Reading records were saved as both hard and electrical copy. The meter readings were also transferred via a remote transmission line to the grid company. The meter was calibrated according to the Chinese industrial standard. The calibration is carried out annually by a qualified organization with the records being supplied to the grid company and project owner.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data/Parameter	EG_{total}
Unit	MWh
Description	Electricity exported to the grid by the project and the other project which share the same main meter with the project
Source of data	Meter reading record of main meter at 220kV substation of power grid
Value(s) applied	To be determined
Measurement methods and procedures	Measuring continuously/recording monthly
Monitoring frequency	N/A
QA/QC procedures	Electricity was monitored continuously by grid company at 220kV substation. The data was monthly recorded. Monthly records from grid company was issued, stamped and sent to project owner. Monthly electricity exported to the grid by the project and the other project is cross-checked against sales receipts. The meter was calibrated according to the Chinese industrial standard. The calibration is carried out annually by a qualified organization with the records being supplied to the grid company and project owner.
Purpose of data	Calculation of baseline emissions

Additional comment	N/A

Data/Parameter	EG_{import}
Unit	MWh
Description	Quantity of annual electricity imported from the grid by the project
Source of data	Meter reading record of main meter at 220kV substation of power grid
Value(s) applied	To be determined
Measurement methods and procedures	Measuring continuously/recording monthly
Monitoring frequency	N/A
QA/QC procedures	Electricity was measured continuously by grid company at 220kV substation. The data was recorded and summarized monthly. Monthly records from grid company was issued, stamped and sent to project owner. Monthly electricity imported from the grid by the project is cross-checked against sales receipts. The meter was calibrated according to the Chinese industrial standard. The calibration is carried out annually by a qualified organization with the records being supplied to the grid company and project owner.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data/Parameter	EG_{export}
Unit	MWh
Description	Quantity of annual electricity exported to the grid by the project
Source of data	Meter reading from E_I, E_{II} and EG_{total}
Value(s) applied	To be determined
Measurement methods and procedures	Measuring continuously/recording monthly and calculation $EG_{export} = EG_{total} \times E_I/(E_I+E_{II})$
Monitoring frequency	N/A
QA/QC procedures	Electricity was recorded by grid company at 220kV substation. The data was monthly recorded. Monthly records from grid company was issued, stamped and sent to project owner. Monthly electricity exported to the grid by the project is cross-checked against sales receipts. The meter was calibrated according to the Chinese industrial standard. The calibration is carried out annually by a qualified organization with the records being supplied to the grid company and project owner.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data/Parameter	EG_y
Unit	MWh
Description	The net electricity supplied to the grid by the project
Source of data	Meter reading from EG_{total}, E_I, E_{II} and EG_{import}
Value(s) applied	To be determined

Measurement methods and procedures	Derived from the difference between EG_{export} and EG_{improt} and the direct measurement results of EG_{total}, E_I, E_{II} and EG_{import} It was calculated from equation: $EG_{export} = EG_{total} \times E_I/(E_I+E_{II})$ $EGy=EG_{export} - EG_{import}$
Monitoring frequency	N/A
QA/QC procedures	The data are calculated by project owner before reported to DOE. Internal auditing reduced the risk of error caused by data transfer and calculation mistakes. Monthly electricity exported to the grid and imported from the grid by the project is cross-checked against sales receipts. The meters were calibrated according to the Chinese industrial standard. The calibration is carried out annually by a qualified organization with the records being supplied to the grid company and project owner.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

B.7.2. Sampling plan

>>
Not applicable.

B.7.3. Other elements of monitoring plan

>>

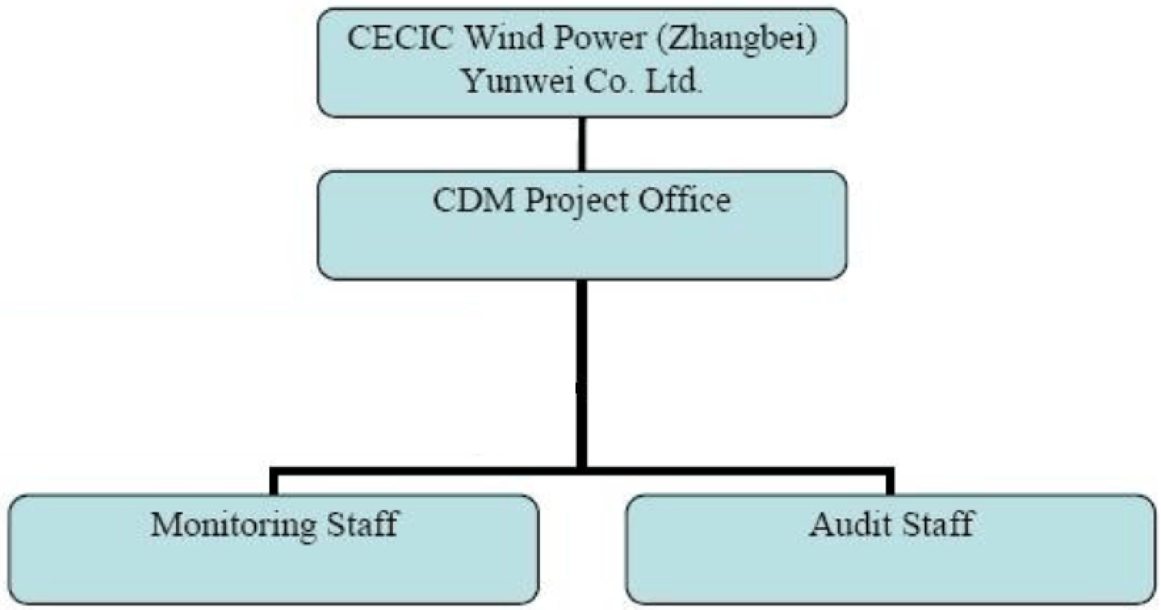
1. Introduction

The approved baseline methodology ACM0002 “Grid-connected electricity generation from renewable sources” is adopted for developing the monitoring plan.

2. Organizational structure and responsibilities

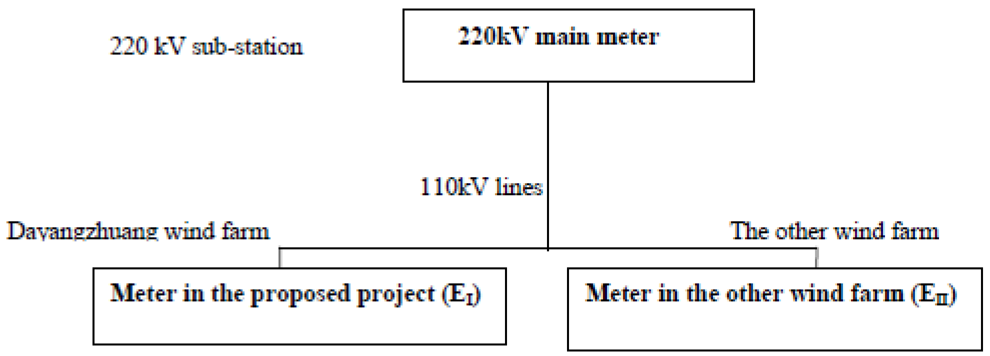
Overall responsibility for monitoring and carrying out the monitoring following this monitoring plan lies with CECIC Wind Power (Zhangbei) Yunwei Co., Ltd.
The CDM manager of CECIC Wind Power (Zhangbei) Yunwei Co. Ltd is responsible for the monitoring and reporting of the wind farm.

The operating and management structure is illustrated as follows:



2. Installation of meters
The electricity supplied to the gird and the electricity imported from the grid base on the main meter installed in Zhangbei 220kV sub-station. Every month Zhangbei 220kV substation reports the electricity exchanged between the project and NCPG via the Zhangbei 220kV substation. The main metering system equipment and the backup metering system equipment were calibrated and maintained by NCPG.

The electricity supplied to NCPG by the project shares one electric flow meter (the main meter) at 220kV level with another wind farm as the following figure shows, so the meter at 220KV level measures the total electricity exchanged between NCPG and the two wind farms.



In the monitoring, NCPG takes independent responsibility to operate the 220kV sub-station and read the main meter installed at the 220kV sub-station. The data gained from the main meter is the total power supply (EG_{total}). The data gained from the meter at 110 kV level installed in the project is E_I. The data gained from the meter at 110 kV level installed in the other wind farm is E_{II}. So, the electricity delivered by the proposed project (EG_{export}) can be calculated as:

$$EG_{export} = EG_{total} \frac{E_I}{E_I + E_{II}} \quad (12)$$

The electricity imported from the grid by the project and the other wind farm shares the same main meter too. So the meter readings the main meter recorded should be the sum of the two wind farms. To be conservative, the imported electricity measured by the main meter is considered as the electricity imported by the project.

3. Monitored data

The main monitored data of the project is the electricity delivered to the grid by the project (EG_{export}) and the power imported from the grid (EG_{import}). The net generation is calculated as exports minus imports.

3.1 Monitoring generation for part of a month

The monitoring procedures follow the generation and invoice months, not necessarily calendar months, for the project activity.

If it is necessary to monitor part of a month, for example if the date of registration is not at the start of the generation month, the following procedure is used:

• A special meter reading will take place on 0:00 of the starting date of the second crediting period.
• A special receipt will be issued based on this special reading for the use of cross-check.

4. Calibration

The metering equipments are calibrated and checked for accuracy according to local industry standards to make sure that any error resulting from such equipment is exceed 0.5% of full-scale rating. The net generation output registered by the meters alone suffices for the purpose of billing and emission reduction verification as long as the error in the meters is within the agreed limits.

Both meters shall be jointly inspected and sealed on behalf of the parties concerned and shall not be interfered with by either party except in the presence of the other party or its accredited representatives.

Calibration is carried out by the qualified third party with the records being supplied to the Wind farm, and these records is maintained by the Wind farm and the third party appointed by DOE.

All the meters installed shall be tested within 10 days after: the detection of a difference larger than the allowable error in the readings of both meters; the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications.

If any errors are detected the party owning the meter shall repair, recalibrate or replace the meter giving the other party sufficient notice to allow a representative to attend during any corrective activity.

Should any previous months reading of the main meter be inaccurate by more than the allowable error, or otherwise functioned improperly, the net generation output shall be determined by (a) first, by reading backup meter, unless a test by either party reveals it is inaccurate; (b) if the backup system is not with acceptable limits of accuracy or operation is performed improperly, the proposed Wind farm and the NCPG shall jointly prepare a reasonable and conservative estimate of the correct reading, and provide sufficient evidence that this estimation is reasonable and conservative when DOE undertakes verification; and (c) if the NCPG and the Wind farm fail to agree then the matter will be referred for arbitration according to agreed procedures.

5. Data collection and management system

• Zhangjiakou Electric Power Company reads main meter and reports the result to NCPG Company monthly.
• Zhangjiakou Electric Power Company supplies reading to the wind farm monthly.
• The wind farm records readings from the backup meter monthly.
• The wind farm carries out an internal audit on the readings and calculations.
• The wind farm calculates the emission reductions after each monitoring period.

Physical document such as paper-based maps, diagrams and environmental assessments is collated in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to the Wind farm project, the project material and monitoring results are indexed. All paper-based information is stored by the technology department of the

Wind farm and all the material have a copy for backup.

And all data including calibration records is kept until 2 years after the end of the total crediting period of the CDM project.

6. Quality control

Monthly net generation data is approved and signed off by CDM manager before it is accepted and stored.
This audit checks compliance with operational procedures in this monitoring plan.
This internal audit identifies potential improvements to procedures to improve monitoring and reporting in future years. If such improvements are proposed these is reported to the DOE and only operated after approval from the DOE.

B.8 Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

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The approved large-scale consolidated methodology ACM0002: “Grid-connected electricity generation from renewable sources”(Version 16.0.0), in effect as of EB 81.

Dr. Zheng Zhaoning of Goldchina Consultancy International Co., Ltd. is responsible for completing the CDM-MR-FORM and the contact information is as follows:

Address: Room 3103, Tangning One Building, Zhongguancun East Road, Haidian District, Beijing, P.R. of China (100083)

Telephone: (8610)6268 2682

Fax: (8610)6268 2682

Email: zzn01@mails.tsinghua.edu.cn, zzn@gcci-carbon.com

Website: www.gcci-carbon.com

The person/entity is not project participant listed in Annex 1.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
28/01/2008 (launch of construction)

C.1.2. Expected operational lifetime of project activity

>>
20 years 0 month

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Renewable crediting period, this is the second crediting period. The first crediting period is from 27/10/2008 to 26/10/2015.

C.2.2. Start date of crediting period

>>
Second crediting period: 27/10/2015-26/10/2022

C.2.3. Length of crediting period

Second crediting period: 7 years 0 month

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
In line with the requirements of local government, an Environmental Impact Assessment (EIA) for the proposed wind farm project was carried out. The EIA has been completed by Hebei Province Engineering Consulting Institute and it has been approved by the Environmental Protection Bureau of Hebei Province. Here is a summary of the EIA.

1 The analysis of the environment impact in the construction period

• Dust: Since the local residential area is 500m away from the wind farm site, the impact of construction dust to the local region is limited. Several measures will be implemented to reduce the impact of dust on local residents and the construction staff, including watering and covering.
• Noise: Construction machines, transportation vehicles and construction work will generate noise. However, the noise levels are within acceptable levels at the nearest habitation, which is 500m away from the project site. Furthermore, using machinery and equipments with low noise levels, and arranging the construction times during day time, reduces the impact to the environment significantly.
• Solid waste: The solid wastes from the construction include waste soil and stone and construction wastes, as well as a little office waste. All these wastes are collected and disposed of properly.
• Waste water: The waste water generated includes washing water from machines and wastewater from the project office. The water will be treated and be used again on the construction site or as fertilizer. So waste water has little impact on the environment.
• Ecosystem: After construction, the land temporally occupied by the project will be recovered by grass, so as to recreate the original ecosystem. So the project has little impact to the ecosystem.

2 The analysis of the environment impact in operation period

• Noise: The operating level of these turbines range from 96dB to 104dB. At a range of 300 meters from the turbines the noise has been greatly weakened, and drops down below the national standard of 45dB. Furthermore, the residential areas are 500m away from the wind farm, so the noise does not influence the residential districts nearest to the site.
• Dust: After revegetation upon completion of the construction work, no dust will be generated by the wind turbines and the growth of the local plant will not be impacted.
• Waste: Solid waste and waste water will be produced by operation staff during operation period. The emitted waste quantity is very small and will cause no interference with the environment after proper treatment or collection.

3. Conclusion

Wind power is green power and the impact caused by wind farm on the surrounding ecosystem, water, noise, and atmosphere is very little. Therefore, the proposed project is feasible from aspect of environment protection.

D.2. Environmental impact assessment

>>

The environmental impacts of the proposed project are not considered significant. The Environmental Protection Bureau of Hebei Province has approved the EIA.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

On May 10th 2007, consultations were carried out in the Zhangbei County by CECIC Wind Power (Zhangbei) Yunwei Co. Ltd. The consultations resulted in a clear support from the local residents. The developer introduced the background of the proposed project by speaker and then made a questionnaire survey using a random sampling method. Respondents filled in a questionnaire with the following sections:

• Project introduction
• Respondent's basic information and education level
• Questions:

1. Do they agree with the development and construction of the project?
2. Will the project have a negative impact on your environment of living, studying and working?
3. Will the project have a negative impact on the environment, such as noise, water and electromagnetism?
4. Will the project have a negative impact on the ecosystem?
5. Do you think the proposed project will have promotion in local economic development?
6. Do you have some suggestion about the project?

E.2. Summary of comments received

>>

The questionnaires were sent to 50 households and the survey had a 100% response rate. The results of the survey indicate support for the project.

• 100% of respondents agreed with the development of the project.
• 100% of respondents believed that the project construction will not do harm to the environment.
• 98% believed that the project construction will do no harm to the ecosystem and 2% didn't have an opinion on this.
• 100% believed that the project construction will have no impact to the environment of living, studying and working.
• 100% believed that the project construction will have positive impact on local economic development.

Conclusions:

The survey shows that the proposed project has strong local support among the local people. They all believe the proposed project will promote the local economic development and agree the project construction.

E.3. Report on consideration of comments received

>>
The local residents are all supportive of the proposed project and to date there has been no need to modify the project design according to the comments received.

The project owner has an overall environment-friendly plan to guarantee that the project has the minimum negative impact on the environment during the project construction and operation.

SECTION F. Approval and authorization

>>
In 2008 April, the China’s LoA was issued.
On May 21, 2008, the Switzerland’s LoA was issued.

- - - - -

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	CECIC Wind Power (Zhangbei) Yunwei Co. Ltd.
Street/P.O. Box	
Building	
City	Zhangjiakou City,
State/Region	Hailiutu Village, Zhangbei County,Hebei Province
Postcode	076750
Country	P.R. China
Telephone	+86 10 8833 7332
Fax	+86 10 8833 7350
E-mail	Dongjuan.Chen@gmail.com
Website	
Contact person	Ms. Chen Dongjuan
Title	
Salutation	
Last name	Chen
Middle name	
First name	Dongjuan
Department	
Mobile	
Direct fax	+86 10 8833 7332
Direct tel.	+86 10 8833 7350
Personal e-mail	Dongjuan.Chen@gmail.com

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Vitol SA
Street/P.O. Box	Arve 28 CH 1205
Building	Boulevard Du Pont-D
City	Geneve
State/Region	
Postcode	3841211
Country	Switzerland
Telephone	+41 22 322 11 11
Fax	+41 22 781 66 11
E-mail	dbf@vitol.com
Website	
Contact person	David Fransen

Title	Manageing director
Salutation	Mr,
Last name	Fransen
Middle name	
First name	David
Department	
Mobile	
Direct fax	+41 22 781 66 11
Direct tel.	+41 22 322 11 11
Personal e-mail	dbf@vitol. com

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Goldchina Consultancy International Co., Ltd.
Street/P.O. Box	Zhongguancun East Road
Building	Tangning One Building
City	Beijing City
State/Region	
Postcode	100083
Country	P.R. China
Telephone	+86 10 62682682
Fax	+86 10 62682682
E-mail	zzn01@mails.tsinghua.edu.cn, zzn@gcci-carbon.com
Website	
Contact person	Zheng Zhaoning
Title	
Salutation	
Last name	Zheng
Middle name	
First name	Zhaoning
Department	
Mobile	
Direct fax	+86 10 62682682
Direct tel.	+86 10 62682682
Personal e-mail	zzn01@mails.tsinghua.edu.cn, zzn@gcci-carbon.com

Appendix 2. Affirmation regarding public funding

Not applicable.

Appendix 3. Applicability of methodology and standardized baseline

For further information, please refer to section B.2.

Appendix 4. Further background information on ex ante calculation of emission reductions

BASELINE INFORMATION

To determine the simple OM emission factor ($EF_{grid,OMsimple,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$) of the Project, data recommended in the *2014 baseline emission factors for regional power grids in China* for the North China Power Grid are adopted.

The following tables summarise the numerical results from the equations listed in the approved methodological tool-*Tool to calculate the emission factor for an electricity system version 04.0.0*. The information provided by the tables includes data, data sources and the underlying calculations. The emission factors of OM and BM are calculated based on the *Tool to calculate the emission factor for an electricity system*. The information provided by the tables includes data, data sources and the underlying calculations.

Table A1.Thermal Electricity generation of the North China Power Grid

year	2010			2011			2012		
Province	EG	AER	EDG	EG	AER	EDG	EG	AER	EDG
	(MWh)	(%)	(MWh)	(MWh)	(%)	(MWh)	(MWh)	(%)	(MWh)
Beijing	26,300,000	6.20	24,669,400	25,800,000	6.00	24,252,000	28,300,000	5.40	26,711,800
Tianjin	55,600,000	6.63	51,913,720	61,200,000	6.40	57,283,200	58,200,000	6.30	54,533,400
Hebei	199,800,000	6.73	186,353,460	215,100,000	6.50	201,118,500	217,800,000	6.40	203,860,800
Shanxi	210,800,000	8.03	193,872,760	229,600,000	8.00	211,232,000	245,400,000	7.60	226,749,600
Inner Mongolia	240,700,000	7.74	222,069,820	288,900,000	7.60	266,943,600	302,900,000	7.40	280,485,400
Shandong	306,400,000	6.98	285,013,280	312,900,000	6.80	291,622,800	324,100,000	5.70	305,626,300
Total			**853,705,050**			**963,892,440**			**1,098,027,300**

Data source: China electric power yearbook, 2011-2013
EG- Electricity generation, AER- Auxiliary electricity consumption Rate, EDG-Electricity delivered to the grid.

Table A2. Calculation of simple OM emission factor of the North China Power Grid in 2010

Energy	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total fuel	Emission factor	NCV	Emission
									$kgCO_2/TJ$	$MJ/t,km^3$	tCO_2
		A	B	C	D	E	F	G=Sum(A:F)	H	I	*J
Coal	kt	6,886.60	24,995.70	88,964.50	93,478.30	138,646.70	136,056.40	**489,028.20**	87,300	20,908	892,607,720
Cleaned coal	kt	-	-	-	-	-	8.70	**8.70**	87,300	26,344	20,009
Other washed coal	kt	53.80	-	1,311.10	6,202.10	885.40	6,467.10	**14,919.50**	87,300	8,363	10,892,576
briquettes	kt	15.30	-	-	-	-	419.80	**435.10**	87,300	20,908	794,174
Coke	kt	-	-	-	-	-	-	**-**	95,700	28,435	-
Coal gangue	kt	-	-	2,522.90	21,209.50	6,011.70	8,980.30	**38,724.40**	87,300	8,363	28,272,293
Coke oven gas	Mm^3	4.00	175.00	1,720.00	2,041.00	440.00	1,186.00	**5,566.00**	37,300	16,726	3,472,515
BFG	Mm^3	1,289.00	1,853.00	29,502.00	4,174.00	4,956.00	20,379.00	**62,153.00**	219,000	3,763	51,220,101
LDG	Mm^3	-	-	848.00	7.00	-	-	**855.00**	145,000	7,945	984,981
Other gas	Mm^3	-	-	-	-	-	-	**-**	37,300	5,227	-
oil	kt	-	-	-	-	-	-	**-**	71,100	41,816	-
gasoline	kt	-	-	-	-	-	-	**-**	67,500	43,070	-
Diesel	kt	1.00	-	22.70	-	5.50	26.60	**55.80**	72,600	42,652	172,787
Fuel oil	kt	4.90	-	1.70	-	0.10	32.40	**39.10**	75,500	41,816	123,443
Naphtha	kt	-	-	-	-	-	-	**-**	72,600	43,906	-
Lubricating Oil	kt	-	-	-	-	-	-	**-**	72,900	41,398	-
Paraffin	kt	-	-	-	-	-	-	**-**	72,200	39,934	-
Solvent Oil	kt	-	-	-	-	-	-	**-**	72,200	42,945	-
Petroleum asphalt	kt	-	-	-	-	-	-	**-**	69,300	38,931	-
Petroleum coke	kt	69.70	124.70	-	-	-	28.20	**222.60**	82,900	31,947	589,535
LPG	kt	-	-	-	-	-	-	**-**	61,600	50,179	-
Refinery gas	kt	13.70	-	21.20	-	-	24.10	**59.00**	48,200	46,055	130,971
Natural gas	Mm^3	160.80	5.70	2.20	61.60	1.80	1.60	**233.70**	54,300	38,931	4,940,309
Other oil products	kt	8.50	-	-	-	-	281.40	**289.90**	72,200	41,816	875,241
Other coke products	kt	-	-	79.90	-	-	34.00	**113.90**	95,700	28,435	309,948
Other energy	kt Ce	204.20	170.70	455.30	346.60	208.00	385.60	**1,770.40**	-	-	-
										subtotal	**995,406,604**

Thermal electricity delivered to the North China Power Grid (MWh)	**963,892,440**
Net electricity import from the Northeast China Power Grid to the North China Power Grid (MWh)	**8,815,880**
The simple OM emission factor of the Northeast China Power Grid (tCO_2/MWh)	**1.1057**
Net electricity import from the Northwest China Power Grid to the North China Power Grid (MWh)	**2,048,870**
The simple OM emission factor of the Northwest China Power Grid (tCO_2/MWh)	**0.9853**
Total emission of the North China Power Grid (tCO_2)	**1,007,173,074**

Total electricity delivered to the North China Power Grid (MWh)	**974,757,190**
Simple OM emission factor of the North China Power Grid in 2010 (tCO_2/MWh)	**1.0333**

* J=G×H×I/1,000,000
Data sources: China energy statistical yearbook 2011
2006 IPCC guideline for national greenhouse gas inventories, volume 2 energy

Table A3. Calculation of simple OM emission factor of the North China Power Grid in 2011

Energy	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total fuel	Emission factor	NCV	Emission
									$kgCO_2$/TJ	MJ/t,km^3	tCO_2
		A	B	C	D	E	F	G=Sum(A:F)	H	I	*J
Coal	kt	6,809.70	28,284.50	100,703.10	103,260.00	189,983.80	137,846.80	**566,887.90**	87,300	20,908	1,034,722,570
Cleaned coal	kt	-	-	-	119.30	28.40	16.70	**164.40**	87,300	26,344	378,092
Other washed coal	kt	-	-	858.60	6,424.70	1,850.90	7,248.10	**16,382.30**	87,300	8,363	11,960,552
briquettes	kt	12.30	-	-	-	-	323.40	**335.70**	87,300	20,908	612,743
Coke	kt	-	-	-	-	-	-	**-**	95,700	28,435	0
Coal gangue	kt	-	-	27,936.00	210,112.00	89,655.00	96,013.00	**423,716.00**	87,300	8,363	30,935,077
Coke oven gas	Mm^3	-	152.00	1,847.00	2,201.00	600.00	1,555.00	**6,355.00**	37,300	16,726	3,964,756
BFG	Mm^3	-	1,608.00	29,860.00	3,690.00	6,032.00	15,941.00	**57,131.00**	219,000	3,763	47,081,486
LDG	Mm^3	-	175.00	1,062.00	102.00	-	1,269.00	**2,608.00**	145,000	7,945	3,004,481
Other gas	Mm^3	-	-	-	-	-	53.00	**53.00**	37,300	5,227	10,333
oil	kt	-	-	-	-	-	-	**-**	71,100	41,816	0
gasoline	kt	-	-	-	-	-	-	**-**	67,500	43,070	0
Diesel	kt	0.90	-	19.60	-	5.60	17.60	**43.70**	72,600	42,652	135,319
Fuel oil	kt	2.50	-	0.80	-	0.20	16.80	**20.30**	75,500	41,816	64,089
Naphtha	kt	-	-	-	-	-	-	**-**	72,600	43,906	0
Lubricating Oil	kt	-	-	-	-	-	-	**-**	72,900	41,398	0
Paraffin	kt	-	-	-	-	-	-	**-**	72,200	39,934	0
Solvent Oil	kt	-	-	-	-	-	-	**-**	72,200	42,945	0
Petroleum asphalt	kt	-	-	-	-	-	-	**-**	69,300	38,931	0
Petroleum coke	kt	58.70	154.20	-	-	-	136.30	**349.20**	82,900	31,947	924,823
LPG	kt	0.10	-	-	-	-	-	**0.10**	61,600	50,179	309
Refinery gas	kt	4.10	0.20	20.20	-	-	32.70	**57.20**	48,200	46,055	126,975
Natural gas	Mm^3	157.00	5.70	1.50	58.50	1.20	1.30	**225.20**	54,300	38,931	4,760,623

Other oil products	kt	8.70	-	23.20	-	-	49.10	**81.00**	72,200	41,816	244,548
Other coke products	kt	-	-	98.10	-	-	12.90	**111.00**	95,700	28,435	302,056
Other energy	kt Ce	185.60	142.90	607.00	659.80	126.30	530.00	**2,251.60**	-	-	0
										subtotal	**1,139,228,834**

Thermal electricity delivered to the North China Power Grid (MWh)	**1,052,452,100**
Net electricity import from the Northeast China Power Grid to the North China Power Grid (MWh)	**10,045,670**
The simple OM emission factor of the Northeast China Power Grid (tCO_2/MWh)	**1.1546**
Net electricity import from the Northwest China Power Grid to the North China Power Grid (MWh)	**25,697,020**
The simple OM emission factor of the Northwest China Power Grid (tCO_2/MWh)	**0.9404**
Total emission of the North China Power Grid (tCO_2)	**1,174,992,213**
Total electricity delivered to the North China Power Grid (MWh)	**1,088,194,790**
Simple OM emission factor of the North China Power Grid in 2011 (tCO_2/MWh)	**1.0798**

* J=G×H×I/1,000,000

Data sources: China energy statistical yearbook 2012
2006 IPCC guideline for national greenhouse gas inventories, volume 2 energy

Table A4. Calculation of simple OM emission factor of the North China Power Grid in 2012

Energy	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total fuel	Emission factor	NCV	Emission
									$kgCO_2/TJ$	MJ/t,km^3	tCO_2
		A	B	C	D	E	F	G=Sum(A:F)	H	I	*J
Coal	kt	6,495.60	27,463.80	95,771.40	108,363.3	202,263.90	132,763.50	**573,121.50**	87,300	20,908	1,046,100,563
Cleaned coal	kt	-	-	-	162.30	10.60	55.20	**228.10**	87,300	26,344	524,591
Other washed coal	kt	-	-	890.40	6,946.70	342.00	20,858.50	**29,037.60**	87,300	8,363	21,200,058
briquettes	kt	14.80	-	-	-	-	310.30	**325.10**	87,300	20,908	593,395
Coke	kt	-	-	-	-	-	-	**-**	95,700	28,435	0
Coal gangue	kt	-	-	1,704.40	20,495	6,115.6	5,912.6	**34,227.60**	87,300	8,363	24,989,225
Coke oven gas	Mm^3	-	110.00	1,746.00	2,031.00	614.00	1,694.00	**6,195.00**	37,300	16,726	3,864,935
BFG	Mm^3	-	1,169.00	32,233.00	4,480.00	5,072.00	23,153.00	**66,107.00**	219,000	3,763	54,478,580
LDG	Mm^3	-	233.00	1,811.00	127.00	-	1,709.00	**3,880.00**	145,000	7,945	4,469,857
Other gas	Mm^3	-	-	-	-	-	74.00	**74.00**	37,300	5,227	14,428
oil	kt	-	81.20	-	-	0.5	-	**81.7**	71,100	41,816	242,904
gasoline	kt	-	-	-	-	-	0.1	**0.1**	67,500	43,070	291
Diesel	kt	1.00	-	13.20	-	7.10	20.60	**41.90**	72,600	42,652	129,745

Fuel oil	kt	1.30	-	0.30	-	0.10	5.00	**6.70**	75,500	41,816	21,153
Naphtha	kt	-	-	-	-	-	-	**-**	72,600	43,906	0
Lubricating Oil	kt	-	-	-	-	-	-	**-**	72,900	41,398	0
Paraffin	kt	-	-	-	-	-	-	**-**	71,900	43,070	0
Solvent Oil	kt	-	-	-	-	-	-	**-**	72,200	42,945	0
Petroleum asphalt	kt	-	-	-	-	-	-	**-**	69,300	38,931	0
Petroleum coke	kt	56.90	174.30	-	-	-	155.70	**386.90**	82,900	31,947	1,024,668
LPG	kt	-	-	-	-	-	-	**-**	61,600	50,179	-
Refinery gas	kt	4.80	0.30	6.0	-	-	20.30	**31.4**	48,200	46,055	69,703
Natural gas	Mm^3	2,122	61	27	521	13	13	**2,757**	54,300	38,931	5,828,169
Other oil products	kt	6.0	-	22.60	-	-	1.00	**29.60**	72,200	41,816	89,366
Other coke products	kt	-	-	134.30	-	-	33.50	**167.80**	95,700	28,435	456,622
Other energy	kt Ce	196.70	126.50	1,219.70	855.40	454.90	609.60	**3,462.80**	-	-	0
										subtotal	**1,164,098,254**

Thermal electricity delivered to the North China Power Grid (MWh)	**1,098,027,300**
Net electricity import from the Northeast China Power Grid to the North China Power Grid (MWh)	**10,926,140**
The simple OM emission factor of the Northeast China Power Grid (tCO_2/MWh)	**1.1225**
Net electricity import from the Northwest China Power Grid to the North China Power Grid (MWh)	**27,079,710**
The simple OM emission factor of the Northwest China Power Grid (tCO_2/MWh)	**0.9546**
Total emission of the North China Power Grid (tCO_2)	**1,202,212,118**
Total electricity delivered to the North China Power Grid (MWh)	**1,088,194,790**
Simple OM emission factor of the North China Power Grid in 2012 (tCO_2/MWh)	**1.0583**

* J=G×H×I/1,000,000

Data sources: China energy statistical yearbook 2013
2006 IPCC guideline for national greenhouse gas inventories, volume 2 energy

Calculated with the data provided in Table A1~Table A4, the OM emission factor of the North China Power Grid is calculated as 1.0580 tCO_2/MWh.
The calculation of average OM emission factor of the Northeast China Power Grid is as follow:

The calculation of simple OM emission factor of the Northeast China Power Grid is as follow:

Table A5. Total electricity generation and total electricity delivered to the Northeast China Power Grid

year	**2010**			**2011**			**2012**		
Province	**EG**	**AER**	**EDG**	**EG**	**AER**	**EDG**	**EG**	**AER**	**EDG**
	(MWh)	(%)	(MWh)	(MWh)	(%)	(MWh)	(MWh)	(%)	(MWh)

Liaoning	123,600,000	6.99	114,960,360	131,600,000	7	122,388,000	134,500,000	6.9	125,219,500
Jilin	52,200,000	7.82	48,117,960	59,200,000	7.6	54,700,800	59,100,000	7.5	54,667,500
Heilongjiang	73,600,000	7.13	68,352,320	77,500,000	6.9	72,152,500	77,200,000	6.6	72,104,800
Total			**213,531,870**			**231,430,640**			**251,991,800**

Data sources: China electric power yearbook 2011-2013

Table A6. Calculation of simple OM emission factor of the Northeast China Power Grid in 2010

Energy	Unit	Liaoning	Jilin	Heilongjiang	Total fuel	Emission factor	NCV	Emission
						$kgCO_2/TJ$	$MJ/t,km^3$	tCO_2
		A	B	C	D= sum(A:C)	E	F	*G
Coal	kt	59,980.90	30,195.90	38,655.90	**128,832.70**	87,300	20,908	235,154,256
Cleaned coal	kt	-	-	-	**-**	87,300	26,344	0
Other washed coal	kt	6,579.60	177.70	2,506.60	**9,263.90**	87,300	8,363	6,763,480
Briquettes	kt	-	-	11.50	**11.50**	87,300	20,908	20,991
Coke	kt	90.10	0.10	-	**90.20**	95,700	28,435	245,455
Coal gangue	kt	1,443.00	-	2,539.50	**3,982.50**	87,300	8,363	2,907,583
Coke oven gas	Mm^3	620.00	77.00	388.00	**1,085.00**	37,300	16,726	676,910
BFG	Mm^3	9,487.00	810.00	129.00	**10,426.00**	219,000	3,763	8,592,035
LDG	Mm^3	30.00	60.00	67.00	**157.00**	145,000	7,945	180,868
Other gas	Mm^3	-	-	-	**-**	37,300	5,227	0
oil	kt	3.40	0.70	-	**4.10**	71,100	41,816	12,190
gasoline	kt	-	-	-	**-**	67,500	43,070	0
Diesel	kt	4.60	8.20	3.40	**16.20**	72,600	42,652	50,164
Fuel oil	kt	67.10	9.90	14.00	**91.00**	75,500	41,816	287,297
Naphtha	kt	-	-	-	**-**	72,600	43,906	0
Lubricating Oil	kt	-	-	-	**-**	72,900	41,398	0

Paraffin	kt	-	-	-	**-**	72,200	39,934	0
Solvent Oil	kt	-	-	-	**-**	72,200	42,945	0
Petroleum asphalt	kt	-	-	-	**-**	69,300	38,931	0
Petroleum coke	kt	-	-	-	**-**	82,900	31,947	0
LPG	kt	-	-	-	**-**	61,600	50,179	0
Refinery gas	kt	140.00	-	592.00	**732.00**	48,200	46,055	162,493
Natural gas	Mm^3	-	21.10	18.90	**40.00**	54,300	38,931	845,581
Other oil products	kt	-	-	-	**-**	72,200	41,816	0
Other coke products	kt	-	-	-	**-**	95,700	28,435	0
Other energy	kt Ce	89.00	257.60	629.50	**976.10**	-	-	0
							subtotal	**255,899,302**
Total Power supply MWh								**231,430,640**
Total emission（tCO_2）								**255,899,302**
average OM emission factor(tCO_2/MWh)								**1.1057**

*G=D×E×F/1,000,000

Data sources: China energy statistical yearbook 2011
2006 IPCC guidelines for national greenhouse gas inventories" volume 2 energy

Table A7. Calculation of simple OM emission factor of the Northeast China Power Grid in 2011

Energy	**Unit**	**Liaoning**	**Jilin**	**Heilongjiang**	**Total fuel**	**Emission factor**	**NCV**	**Emission**
						$kgCO_2$/TJ	**MJ/t,km^3**	**tCO_2**
		A	**B**	**C**	**D= sum(A:C)**	**E**	**F**	***G**
Coal	kt	66,448.70	37,026.90	43,844.70	**147,320.30**	87,300	20,908	268,899,088
Cleaned coal	kt	-	160.90	-	**160.90**	87,300	26,344	370,043
Other washed coal	kt	6,604.10	-	723.50	**7,327.60**	87,300	8,363	5,349,807
Briquettes	kt	-	-	11.40	**11.40**	87,300	20,908	20,808

Coke	kt	36.70	-	-	**36.70**	95,700	28,435	99,869
Coal gangue	kt	1,100.00	-	2,547.50	**3,647.50**	87,300	8,363	2,663,003
Coke oven gas	Mm^3	543.00	121.00	-	**664.00**	37,300	16,726	414,256
BFG	Mm^3	8,881.00	848.00	-	**9,729.00**	219,000	3,763	8,017,640
LDG	Mm^3	386.00	96.00	56.00	**538.00**	145,000	7,945	619,789
Other gas	Mm^3	-	-	-	**-**	37,300	5,227	-
oil	kt	12.10	-	-	**12.10**	71,100	41,816	35,975
gasoline	kt	-	-	-	**-**	67,500	43,070	-
Diesel	kt	6.00	5.40	3.60	**15.00**	72,600	42,652	46,448
Fuel oil	kt	74.50	9.80	8.20	**92.50**	75,500	41,816	292,032
Naphtha	kt	-	-	-	**-**	72,600	43,906	-
Lubricating Oil	kt	-	-	-	**-**	72,900	41,398	-
Paraffin	kt	-	-	-	**-**	72,200	39,934	-
Solvent Oil	kt	-	-	-	**-**	72,200	42,945	-
Petroleum asphalt	kt	-	-	-	**-**	69,300	38,931	-
Petroleum coke	kt	-	-	-	**-**	82,900	31,947	-
LPG	kt	-	-	-	**-**	61,600	50,179	-
Refinery gas	kt	14.40	-	95.70	**110.10**	48,200	46,055	244,406
Natural gas	Mm^3	-	199.00	136.00	**335.00**	54,300	38,931	708,174
Other oil products	kt	-	-	-	**-**	72,200	41,816	-
Other coke products	kt	-	-	-	**-**	95,700	28,435	-
Other energy	kt Ce	51.80	312.10	861.20	**1,225.10**	-	-	-
							subtotal	**287,781,338**
Total Power supply MWh								**249,241,300**
Total emission（tCO_2）								**287,781,338**
average OM emission factor(tCO_2/MWh)								**1.1546**

*G=D×E×F/1,000,000

Data sources: China energy statistical yearbook 2012
China energy statistical yearbook 2008; 2006 IPCC guidelines for national greenhouse gas inventories" volume 2 energy

Table A8. Calculation of simple OM emission factor of the Northeast China Power Grid in 2012

Energy	Unit	Liaoning	Jilin	Heilongjiang	Total fuel	Emission factor	NCV	Emission
						$kgCO_2/TJ$	MJ/t,km^3	tCO_2
		A	B	C	D= sum(A:C)	E	F	*G
Coal	kt	62,725.90	36,804.90	42,599.30	**142,130.10**	87,300	20,908	259,425,580
Cleaned coal	kt	-	128.30	-	**128.30**	87,300	26,344	295,068
Other washed coal	kt	6,522.90	-	1,054.3	**7,577.2**	87,300	8,363	5,532,037
Briquettes	kt	-	-	-	**-**	87,300	20,908	-
Coke	kt	39.10	-	-	**39.10**	95,700	28,435	106,400
Coal gangue	kt	3,416.5	-	4,066.70	7,483.20	87,300	8,363	5,463,409
Coke oven gas	Mm^3	969.00	51.00	264	1, 284.00	37,300	16,726	801,062
BFG	Mm^3	10,313.00	652.00	328	**11,293.00**	219,000	3,763	9,306,527
LDG	Mm^3	517.00	45.00	15.00	**577.00**	145,000	7,945	664,718
Other gas	Mm^3	-	-	-	**-**	37,300	5,227	-
oil	kt	4.10	-	-	**4.10**	71,100	41,816	12,190
gasoline	kt	-	-	-	**-**	67,500	43,070	-
Diesel	kt	4.3	5.3	3.40	**13.00**	72,600	42,652	40,255
Fuel oil	kt	73.40	5.60	13.4	**92.40**	75,500	41,816	291,717
Naphtha	kt	-	-	-	**-**	72,600	43,906	-
Lubricating Oil	kt	-	-	-	**-**	72,900	41,398	-
Paraffin	kt	-	-	-	**-**	72,200	39,934	-
Solvent Oil	kt	-	-	-	**-**	72,200	42,945	-
Petroleum asphalt	kt	-	-	-	**-**	69,300	38,931	-
Petroleum coke	kt	-	-	-	**-**	82,900	31,947	-

LPG	kt	-	-	-	**-**	61,600	50,179	-
Refinery gas	kt	14.10	-	89.60	**103.70**	48,200	46,055	230,199
Natural gas	Mm^3	-	202.00	118.00	**320.00**	54,300	38,931	676,465
Other oil products	kt	-	1.00	-	**1.00**	72,200	41,816	3,019
Other coke products	kt	-	-	-	**-**	95,700	28,435	-
Other energy	kt Ce	79.2	490.1	104.8	**674.1**	-	-	-
							subtotal	**282,848,646**
Total Power supply MWh								**251,991,800**
Total emission（tCO_2）								**282,848,646**
average OM emission factor(tCO_2/MWh)								**1.1225**

*G=D×E×F/1,000,000

Data sources: China energy statistical yearbook 2013
China energy statistical yearbook 2008; 2006 IPCC guidelines for national greenhouse gas inventories” volume 2 energy

Table A9. Total electricity generation and total electricity delivered to the Northwest China Power Grid

year	**2010**			**2011**			**2012**		
Province	**EG**	**AER**	**EDG**	**EG**	**AER**	**EDG**	**EG**	**AER**	**EDG**
	(MWh)	**(%)**	**(MWh)**	**(MWh)**	**(%)**	**(MWh)**	**(MWh)**	**(%)**	**(MWh)**
shaanxi	95,800,000	7.23	88,873,660	108,400,000	7.2	100,595,200	114,900,900	7.1	106,742,100
gansu	59,100,000	6.73	55,122,570	71,400,000	6.8	66,544,800	66,600,00	6.5	62,271,000
qinghai	10,900,000	6.58	10,182,780	12,200,000	7.2	11,321,600	12,000,000	7.9	11,052,000
ningxia	57,200,000		57,200,000	96,700,000		96,700,000	95,200,000		95,200,000
xinjiang	53,900,000	8.7	49,210,700	72,500,000	8.2	66,555,000	99,800,000,	8.1	91,716,200
Total			**260,589,710**			**341,716,600**			**366,981,300**

Data sources: China electric power yearbook 2011-2013

Table A10. Calculation of simple OM emission factor of the Northwest China Power Grid in 2010

Energy	Unit	shaanxi	gansu	qinghai	ningxia	xinjiang	Total fuel	Emission factor	NCV	Emission
								$kgCO_2/TJ$	$MJ/t,km^3$	tCO_2
		A	B	C	D	E	F= sum(A:E)	G	H	*I
Coal	kt	48504.9	27718.9	4837.2	29164.6	24949	**135174.6**	87,300	20,908	246,729,926
Cleaned coal	kt	-	-	-	10.5	-	**10.5**	87,300	26,344	24,148
Other washed coal	kt	110.1	-	-	429.6	68.2	**607.9**	87,300	8,363	443,822
Briquettes	kt	-	-	-	-	-	**-**	87,300	20,908	-
Coke	kt	-	-	-	-	-	**-**	95,700	28,435	-
Coal gangue	kt	3551.3	378.6	-	1635.8	28.5	**5594.2**	87,300	8,363	4,084,269
Coke oven gas	Mm^3	197	89	-	-	70	**356**	37,300	16,726	222,101
BFG	Mm^3	1824	406	-	-	528	**2758**	219,000	3,763	2,272,860
LDG	Mm^3	-	31	-	-	-	**31**	145,000	7,945	35,713
Other gas	Mm^3	-	-	-	-	-	**-**	37,300	5,227	-
oil	kt	-	-	-	-	-	**-**	71,100	41,816	-
gasoline	kt	0.1	-	0.3	-	0.1	**0.5**	67,500	43,070	1,454
Diesel	kt	6.7	4.2	2.1	2.3	3.9	**19.2**	72,600	42,652	59,453
Fuel oil	kt	-	1.7	0.9	1	7	**10.6**	75,500	41,816	33,465
Naphtha	kt	-	-	-	-	-	**-**	72,600	43,906	-
Lubricating Oil	kt	-	-	-	-	-	**-**	72,900	41,398	-
Paraffin	kt	-	-	-	-	-	**-**	72,200	39,934	-
Solvent Oil	kt	-	-	-	-	-	**-**	72,200	42,945	-
Petroleum asphalt	kt	-	-	-	-	-	**-**	69,300	38,931	-
Petroleum coke	kt	-	-	-	-	-	**-**	82,900	31,947	-
LPG	kt	-	-	-	-	-	**-**	61,600	50,179	-

Refinery gas	kt	-	-	-	-	122	**122**	48,200	46,055	270,822
Natural gas	Mm^3	87	-	248	30	854	**1219**	54,300	38,931	2,576,909
Other oil products	kt	-	-	-	-	0.1	**0.1**	72,200	41,816	302
Other coke products	kt	-	-	-	-	-	**-**	95,700	28,435	-
Other energy	kt Ce	17.6	26.8	-	-	-	**44.4**	-	-	-
									subtotal	**256,755,243**

Total electricity supply to NWPG (MWh)	**260,589,710**
Total emission of NWPG	**256,755,243**
Emission factor of the NWPG in 2010 (tCO_2/MWh)	**0.9853**

Data sources: China energy statistical yearbook 2011
2006 IPCC guidelines for national greenhouse gas inventories" volume 2 energy

Table A11. Calculation of simple OM emission factor of the Northwest China Power Grid in 2011

Energy	Unit	shaanxi	gansu	qinghai	ningxia	xinjiang	Total fuel	Emission factor	NCV	Emission
								$kgCO_2/TJ$	$MJ/t,km^3$	tCO_2
		A	B	C	D	E	F= sum(A:E)	G	H	*I
Coal	kt	41075.6	34274	5566.8	50517.3	33589.4	**165023.1**	87,300	20,908	301,211,450
Cleaned coal	kt	-	-	-	-	-	**-**	87,300	26,344	0
Other washed coal	kt	14733.8	-	-	423.6	96.2	**15253.6**	87,300	8,363	11,136,499
Briquettes	kt	-	-	-	-	-	**-**	87,300	20,908	-
Coke	kt	-	-	-	-	-	**-**	95,700	28,435	-
Coal gangue	kt	2518.8	415.3	-	1705.1	695.3	**5334.5**	87,300	8,363	3,894,665
Coke oven gas	Mm^3	635	66	-	5	138	**844**	37,300	16,726	526,555
BFG	Mm^3	-	468	-	14	447	**929**	219,000	3,763	765,586

LDG	Mm^3	-	108	-	-	105	**213**	145,000	7,945	245,381
Other gas	Mm^3	-	-	-	-	-	**-**	37,300	5,227	-
oil	kt	-	-	-	-	-	**-**	71,100	41,816	-
gasoline	kt	-	-	-	-	-	**-**	67,500	43,070	-
Diesel	kt	6.6	4.7	4.7	2.9	7.4	**26.3**	72,600	42,652	81,439
Fuel oil	kt	-	1.5	0.8	4.7	0.6	**7.6**	75,500	41,816	23,994
Naphtha	kt	-	-	-	-	-	**-**	72,600	43,906	-
Lubricating Oil	kt	-	-	-	-	-	**-**	72,900	41,398	-
Paraffin	kt	-	-	-	-	-	**-**	72,200	39,934	-
Solvent Oil	kt	-	-	-	-	-	**-**	72,200	42,945	-
Petroleum asphalt	kt	-	-	-	-	-	**-**	69,300	38,931	-
Petroleum coke	kt	-	-	-	-	-	**-**	82,900	31,947	-
LPG	kt	-	-	-	-	-	**-**	61,600	50,179	-
Refinery gas	kt	-	-	-	-	79.9	**79.9**	48,200	46,055	177,366
Natural gas	Mm^3	83	0	462	77	926	**1548**	54,300	38,931	3,272,400
Other oil products	kt	-	-	-	-	-	**-**	72,200	41,816	-
Other coke products	kt	-	-	-	-	-	**-**	95,700	28,435	-
Other energy	kt Ce	5.6	27.8	-	-	68	**101.4**	-	-	-
									subtotal	**321,335,334**

Total electricity supply to NWPG (MWh)	**341,716,600**
Total emission of NWPG	**321,335,334**
Emission factor of the NWPG in 2011 (tCO_2/MWh)	**0.9404**

I= G*H*F /1000000

Data sources: China energy statistical yearbook 2012.

2006 IPCC guideline on national GHG inventories, Volume 2

Table A12. Calculation of simple OM emission factor of the Northwest China Power Grid in 2012

Energy	Unit	shaanxi	gansu	qinghai	ningxia	xinjiang	Total fuel	Emission factor	NCV	Emission
								$kgCO_2/TJ$	$MJ/t,km^3$	tCO_2
		A	B	C	D	E	F= sum(A:E)	G	H	*I
Coal	kt	41,604.4	34,453.8	6034.7	46,264.8	49,668.7	**178,026.4**	87,300	20,908	324,945,962
Cleaned coal	kt	-	-	-	-	-	**-**	87,300	26,344	-
Other washed coal	kt	15,226.2	-	-	3,518.3	84.5	**18,829**	87,300	8,363	13,746,863
Briquettes	kt	-	-	-	-	-	**-**	87,300	20,908	-
Coke	kt	-	-	-	-	-	**-**	95,700	28,435	-
Coal gangue	kt	2,865.9	411.6	-	1007.6	1,148.8	**5,433.9**	87,300	8,363	3,967,236
Coke oven gas	Mm^3	1,657	50	-	123	264	**2,094**	37,300	16,726	1,306,404
BFG	Mm^3	2345	376	-	65	422	**3208**	219,000	3,763	2,643,703
LDG	Mm^3	-	101	-	-	177	**278**	145,000	7,945	320,263
Other gas	Mm^3	-	-	-	-	-	**-**	37,300	5,227	-
oil	kt	-	-	-	-	-	**-**	71,100	41,816	-
gasoline	kt	-	-	-	-	-	**-**	67,500	43,070	-
Diesel	kt	4.5	3.4	2.7	1.9	6.8	**19.3**	72,600	42,652	59,763
Fuel oil	kt	-	0.7	0.7	4.0	0.5	**5.9**	75,500	41,816	18,627
Naphtha	kt	-	-	-	-	-	**-**	72,600	43,906	-
Lubricating Oil	kt	-	-	-	-	-	**-**	72,900	41,398	-
Paraffin	kt	-	-	-	-	-	**-**	72,200	39,934	-
Solvent Oil	kt	-	-	-	-	-	**-**	72,200	42,945	-
Petroleum asphalt	kt	-	-	-	-	-	**-**	69,300	38,931	-
Petroleum coke	kt	-	-	-	-	-	**-**	82,900	31,947	-

LPG	kt	-	-	-	-	-	**-**	61,600	50,179	-
Refinery gas	kt	-	15.8	-	-	53.1	**68.9**	48,200	46,055	152,948
Natural gas	Mm^3	94	-	439	56	902	**1491**	54,300	38,931	3,151,904
Other oil products	kt	-	-	-	-	-	**-**	72,200	41,816	-
Other coke products	kt	-	-	-	-	-	**-**	95,700	28,435	-
Other energy	kt Ce	5.6	27.8	-	-	68	**101.4**	-	-	-
									subtotal	**350,313,673**

Total electricity supply to NWPG (MWh)	**366,981,300**
Total emission of NWPG	**350,313,673**
Emission factor of the NWPG in 2012 (tCO_2/MWh)	**0.9546**

I= G*H*F /1000000
Data sources: China energy statistical yearbook 2013.
2006 IPCC guideline on national GHG inventories, Volume 2

The section Baseline emissions factor detailed the calculation of BM emission factor of North China Power Grid, as per *2014 baseline emission factors for regional power grids in China* published by China DNA on May 11, 2015 details as follows:

Sub-step 1: Calculation of the share of CO_2 emissions from solid, liquid and gaseous fuels.
Calculated with the data provided in Table A4 and equations (4), (5) and (6), $\lambda_{Coal,y}$ =93.97%, $\lambda_{Oil,y}$ =0.13%, $\lambda_{Gas,y}$ =5.90%

Sub-step 2: with weight of the proportion calculated in Step1, Calculated the emission factor of thermal power based on the emission factors of the best efficient and commercial generation technologies as follow:

Thermal Power Technologies	variable	Electricity supply efficiency (%)	Emission factor of fuel($kgCO_2$)	Emission factor(tCO_2/MWh)
		A	B	C=3.6/A/1,000,000×B
Coal fired power plants	$EF_{Coal,Adv,y}$	40.03%	87,300	**0.7851**
Oil fired power plants	$EF_{Oil,Adv,y}$	52.90%	75,500	**0.5138**
Gas fired power plants	$EF_{Gas,Adv,y}$	52.90%	54,300	**0.3695**

As per equation (7)

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y}$$

=93.97%×0.7851+0.13 %×0.5138+5.90%×0.3695

=0.76022 tCO_2e/MWh

Sub-step 3: take the thermal power emission factor calculated in the Step 2 multiplied by the proportion count for 20% of capacity addition of the grid as the Build Margin emission factor ($EF_{grid,BM,y}$)

Table A13. Installed capacity of the North China Power Grid in 2012

Installed capacity	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	6,140	11,100	39,990	50,110	60,190	68,180	235,710
Hydro power (MW)	1,020	5	1,790	2,430	1,080	1,077	7,402
Nuclear power (MW)	-	-	-	-	-	-	-
Wind power and Other (MW)	150	232	6,900	2,007	17,140	3,886	30,315
Total (MW)	**7,310**	**11,337**	**48,680**	**54,547**	**78,410**	**73,143**	**273,427**

Data source: China electric power yearbook 2013.

Table A14. Installed capacity of the North China Power Grid in 2011

Installed capacity	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	5,140	10,830	38,100	46,510	59,550	64,480	224,610
Hydro power (MW)	1,050	10	1,790	2,430	850	1,069	7,199
Nuclear power (MW)	-	-	-	-	-	-	-
Wind power and Other (MW)	150	130	4,617	927	14,657	2,497	22,978

Total (MW)	**6,340**	**10,970**	**44,507**	**49,867**	**75,057**	**68,046**	**254,787**

Data source: China electric power yearbook 2012.

Table A15. Installed capacity of the North China Power Grid in 2010

Installed capacity	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	5,140	10,910	36,640	42,100	54,020	60,020	208,830
Hydro power (MW)	1,050	10	1,790	1,820	850	1,070	6,590
Nuclear power (MW)	-	-	-	-	-	-	-
Wind power and Other (MW)	110	30	3,720	370	9,730	1399	15,359
Total (MW)	**6,300**	**10,950**	**42,150**	**44,290**	**64,600**	**62,489**	**230,779**

Data source: China electric power yearbook 2011.

Table A16. Installed capacity of the North China Power Grid in 2009

Installed capacity	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	5,120	10,030	35,140	39,150	48,300	58,860	196,600
Hydro power (MW)	1,050	10	1,790	1610	830	1,060	6,350
Nuclear power (MW)	-	-	-	-	-	-	-
Wind power and Other (MW)	50	-	1360	120	6,420	860	8,810
Total (MW)	**6,220**	**10,040**	**38,290**	**40,880**	**55,550**	**60,780**	**211,760**

Data source: China electric power yearbook 2010.

Table A17. Calculation of BM emission factor of the North China Power Grid

	Installed capacity in 2009	Installed capacity in 2010	Installed capacity in 2011	Installed capacity in 2012	Capacity additions from 2009 to 2012	Capacity additions from 2010 to 2012[3]	Share in total capacity additions
Unit	**MW**	**MW**	**MW**	**MW**	**MW**	**MW**	
	A	**B**	**C**	**D**	**E**	**F**	**G**
Thermal power	196,600	208,830	224,610	235,710	50,248	31,135	71.17%
Hydro power	6,350	6,590	7,199	7,402	-1,148	212	-1.63%
Nuclear power	-	-	-	-	-	-	0.00%
Wind power and Other	8,810	15,359	22,978	30,315	21,505	14,956	30.46%
Total	211,760	230,779	254,787	273,427	70,605	46,303	100%
Share in total installed capacity of 2012					25,82%	16.93%	

$EF_{grid,BM,y}$ =0.76022*71.17%=0.5410tCO_2/MWh

Table A18. Calculation of CM emission factor

	Value	**weight**	**CM**
OM(tCO_2/MWh)	1.0580	0.75	0.92875
BM(tCO_2/MWh)	0.5410	0.25	

[3] The data is the newly added installed capacity after taking into consideration of installed capacity, capacity for closing and stopping the unit, capacity for pumping and storing energy.

Appendix 5. Further background information on monitoring plan

Not applicable

Appendix 6. Summary of post registration changes

Not applicable

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